

### Comb system for tool spacers

The present invention relates to a fixing system for mounting and demounting a bending tool on the upper 5 beam of a bending press.

Bending presses are used for the forming of materials in sheet form and for that comprise one or several tools commonly known as punches fixed on the moving 10 beam of the machine by a fixing system or tool holder and, facing these tools, one or several V-shaped dies fixed on the upper edge of the lower beam of the bending press.

15 By positioning the sheet that is to be formed on the die and lowering the punch by a predetermined amount, the sheet can be bent to the desired angle.

Furthermore, the tool used differs according to the 20 type of forming and the size of forming to be effected on the sheet-formed materials. It is therefore necessary to be able to demount the tool from the top beam, that is to say from the fixing system and replace it with another more suitable tool.

25 As is well known, the fixing of the tool which comprises a fixing heel is performed using a clamp mounted to pivot which can occupy a first tool-clamping position or a second separated position allowing the 30 tool to be changed.

It will also be understood that bending tools are relatively heavy. It is therefore highly desirable for the tool to be held on the clamp even when this clamp 35 is in the unclamped position, so as to avoid any risk of the tool dropping onto the die of the lower beam arranged facing this tool.

French patent application 00 07 415 in the name of the applicant company describes one embodiment of a tool holder or tool fixing system that allows effective control over the pivoting of the clamp and retention of  
5 the tool after the clamp has been unclamped.

The appended figures 1A and 1B depict the embodiment of the tool fixing system described in the abovementioned patent application. These figures depict the moving  
10 upper beam 10 and the tool spacer 12 fixed by any appropriate means to the upper beam 10. The tool spacer comprises a lower part 14 of smaller thickness defined by two shoulders 16 and 18.

15 The fixing system also comprises a clamp 20 mounted to pivot about a horizontal axis parallel to the length of the beam. The pivot axis may be defined by ball-headed screws 22 collaborating with corresponding bore holes 24 machined in the middle part 26 of the clamp 20. To  
20 cause the clamp 20 to pivot about the axis defined by the heads of the ball-headed screws 22, use may be made of push-rods 28, one end of which acts on the upper end 30 of the clamp 20 and the second end of which collaborates with a rotary cam 32 mounted in the tool  
25 spacer 12 in the longitudinal direction of the beam. In this embodiment, the cam 32, in the position depicted in figure 1A, causes the upper part 30 of the clamp to move away, and this corresponds to the clamped position. By contrast, in its position depicted in  
30 figure 1B, the cam 32 no longer acts on the push-rods 30 and, under the effect of an elastic system, the clamp 20 adopts the position for mounting-demounting the tool, which position is depicted in figure 1B.

35 The tool 34 comprises at its upper part a fixing heel 36 which has a first fixing face 36a, a second fixing face 36b parallel to the first fixing face and a retaining groove 38.

In the clamped position depicted in figure 1A, the fixing surfaces 36a and 36b of the heel of the tool are trapped between the clamping face 14a of the end 14 of the tool spacer and the clamping face 40 of the lower 5 part 42 of the clamp 20.

Furthermore, at its lower end 42, the clamp comprises a retaining means 44 in the form of a nib that can enter a groove 38 in the heel of the tool 34. When the clamp 10 20 is in the clamped position depicted in figure 1A, the nib 44 has no effect. By contrast, when the lower end 42 of the clamp is moved away to occupy the mounting-demounting position, the nib 44 remains partially engaged in the groove 38, and this keeps the 15 tool 34 in a vertical direction with respect to the tool spacer 12.

This system allows effective retention of the tool preventing it from falling out, but nonetheless has the 20 following disadvantage. When the clamp 20 is brought into its mounting-demounting position, the tool 34 can be removed only via the longitudinal ends of the clamp 20 by sliding the heel of the tool between the clamp and the lower part 14 of the tool spacer.

25 It will be understood that, because the tool can be fitted between the lower part of the tool spacer and the clamp only laterally, that is to say from the ends of the clamp, when the operator wishes to replace a 30 tool which is mounted, for example, in the central part of the clamp, he has first of all to demount the tools arranged between the tool that actually needs to be changed and one of the ends of the clamp.

35 These relatively tricky operations of removing a plurality of tools appreciably increase the time spent changing the desired tool and therefore lead to a loss of productivity of the bending press. The higher the

frequency at which the tools need to be changed, the more time is lost.

One object of the present invention is to provide a  
5 system for fixing a tool to the top beam of a bending  
press that allows the tools to be mounted and demounted  
frontally on the top beam, thus making it possible  
actually to change only the required tool.

10 Another object of the invention is to provide a tool  
fixing system in which the tool retaining means are  
simple and inexpensive to manufacture and easy to mount  
on the press.

15 To achieve this objective, according to the invention,  
the system for fixing a bending tool, said tool  
comprising two parallel surfaces for fixing by clamping  
and a retaining groove, comprises a clamping body  
having a first clamping surface able to collaborate  
20 with one of the fixing surfaces of the tool and a tool  
clamp mounted so that it can pivot and comprising a  
second clamping surface, said clamp being able to adopt  
a first tool clamping position in which the fixing  
surfaces of the tool are clamped between the first and  
25 second clamping surfaces and a second position for  
mounting/demounting the tool, in which position its  
clamping surface is separated from the first clamping  
surface of the clamping body.

30 This fixing system is one which further comprises a  
tool retaining member comprising a number of mutually  
parallel elastically deformable blades arranged in the  
same plane, each blade comprising a first end secured  
35 to the clamping body, a running part arranged in such a  
way that it is pressed against the first fixing face of  
the tool and a second end comprising at least a first  
angled part angled toward the tool with respect to the  
running part and a second angled part angled in the  
opposite direction so that said angled parts, when said

blade is at rest, are held elastically in the groove of the tool and so that when the clamp is in the loading/unloading position, the running part of the blade can deform elastically to allow said angled parts 5 of the elastically deformable blades to be introduced into or extracted from said groove.

It will be understood that, by virtue of the presence of the elastic retaining blades which end in the two 10 angled portions, it is possible to fit and withdraw a bending tool from the front face of the bending machine. Indeed, having brought the clamp into its mounting/demounting position, the tool can be fitted or withdrawn by elastic deformation of the running part of 15 the blades under the effect of the collaboration in one direction or the other of one or other of the angled portions at the end of the elastic blade with the fixing heel of the tool. In addition, this elastic retention system ensures that the tool is held as 20 effectively as it was in the systems of the prior art once the clamp has been unclamped.

Furthermore, it is clearly evident that the cost of manufacture and of mounting of the retaining piece is 25 low because this is preferably a simple metal sheet cut and bent to obtain the various elastic blades with their two angled parts able to enter the tool retaining groove.

30 Finally, it will be understood that the presence of the two angled parts allows easy insertion and extraction of the retaining means into and from the retaining groove, thus avoiding the risk of stressing or deforming the elastic blades, as such actions would be 35 prejudicial to the life of the retaining system.

As a preference, when a tool is in the fixed position, the running part of the elastic blade bears against the fixing surface of the tool and the first angled portion

is in contact with the chamfer which connects the fixing surface of the tool and the upper wall of the groove.

5 Also as a preference, each elastically deformable blade further comprises, beyond said second angled portion, a connecting portion and an alignment portion arranged at the end of the connecting part, said alignment portion running roughly parallel to the running part of the  
10 blade facing at least said second angled portion, said alignment part being able to enter an alignment groove formed in the lower face of the clamp and parallel to the axis of pivoting thereof.

15 Again according to a preferred embodiment, said alignment groove comprises an alignment wall which collaborates with the alignment portion of the elastically deformable blades when the clamp is in its loading/unloading position.

20 It will be understood that, by virtue of the presence of the alignment wall formed in the alignment groove of the clamp, the alignment portions of the elastically deformable blades can actually all be aligned and the  
25 same therefore can be said of the angled portions of the elastically deformable blades, thus making fitting or extracting the bending tool far easier.

Other characteristics and advantages of the invention  
30 will become better apparent from reading the description which follows of one embodiment of the invention given by way of nonlimiting example. The description refers to the attached figures in which:

35 - figures 1A and 1B already described show a system for fixing a bending tool of known type in the active position and in the rest position;

- figure 2 is an elevation of the entirety of a tool fixing system according to the invention;
- figure 3 is a detail view showing the lower end of the retaining blades when the clamp is in the clamped position;
- figure 4 is a detail view showing the lower end of the retaining blade when the clamp is in the mounting/demounting position; and
- figure 5 is an elevation of a preferred embodiment of the retaining member.

15 Referring first of all to figure 2, a description will be given of the entirety of the tool fixing system. This figure 2 again shows the upper beam 10 of the bending press, the tool spacer 12 with its reduced-width lower portion 14 defined by the shoulders 16 and 18, the lower part 14 defining one of the clamping faces 14a. It also again shows the clamp 20, 20' with its upper part 30 and its lower end 42. Figure 2 schematically depicts the axis of pivoting 22, 22' of the clamps 20, 20' and of the actuators 28, 32 for controlling the pivoting of each clamp about the axes 22, 22'. The axes 22, 22' and the means for controlling the pivoting of the clamp can be embodied in any way, for example in the kind of way depicted in figures 1A and 1B.

30 It is important to point out right now that the clamp 20 at its lower end 42 does not have the retaining nib 44 of figure 1A.

35 Figure 2 also depicts the bending tool 34 with its fixing heel 36 and its retaining groove 38. The fixing heel 36 comprises two fixing faces 36a and 36b able to collaborate with the clamping face 14a of the tool

spacer and the clamping face of the clamp, as will be explained.

In the embodiment described, the lower part of the  
5 clamp 42 in its face facing toward the tool spacer  
comprises two inserts in the form of longitudinal  
strips 50 and 52 defining a clamping surface with the  
same function as the clamping surface 40 of the clamp  
20 depicted in figure 1A.

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It will be understood that the clamp 20 can pivot  
between a first, fixing position in which the heel 36  
of the tool is clamped between the extension 14 of the  
tool spacer and the clamping surface consisting of the  
15 strips 50 and 52 and a second position of the clamp 20,  
for mounting/demounting, in which position the clamping  
surfaces 50, 52 are separated from the heel 36 of the  
bending tool.

20 According to the invention, retention of the bending  
tool is obtained by a retaining member bearing the  
general reference 54 and depicted in greater detail in  
figure 5. This retaining member 54 preferably consists  
of an elastically deformable metal plate 56 in which  
25 elastically deformable blades 58 are defined. Each  
elastically deformable blade 58 is separated from the  
adjacent blades by a slot 60.

30 The width  $l$  of each elastically deformable blade is  
determined in relation to the lengths of the bending  
tools themselves, according to the length of the  
bending machine, so that each blade 58 presses against  
the heel of just one bending tool.

35 As best shown in figure 2, each blade 58 comprises a  
first fixing end 58a fixed by any appropriate means 62  
to the tool spacer 12, a running part 58b and a  
retaining end 58c. At rest, that is to say when the  
blade 58 is not deformed and when the tool is mounted,

its running part 58b is pressed against the fixing face 36a of the heel 36 of the tool. The retaining end 58c of each blade 58 is arranged in such a way that it can enter the groove 38 of the heel of the tool when the 5 latter is in the fixing position on the tool spacer 12.

As best shown in figures 3 and 4, the retaining part 58c of each blade 58 comprises a first angled part 64 which makes, for example, an angle of the order of 45° 10 with respect to the direction of the running part 58b of the blade. The angling is such that this portion can enter the groove 38 of the heel of the bending tool. The retaining part also comprises a second angled portion 66 angled in the opposite direction, so that 15 the angled portions 64 and 66 together form an open V of vertex A. The bend 68 which connects the flat running part 58b to the first angled portion 64 is defined in such a way that, at rest, the chamfer 70 that connects the fixing face 36a of the heel of the 20 tool to the upper wall 72 of the groove 38 presses against the first end of the angled portion 64. Of course, the angled portions 64, 66 are defined in such a way that the angled portions can entirely enter the groove 38.

25 The lower end 58c of each blade 58 additionally comprises an alignment portion 76 roughly parallel to the running part 58b of the blade and connected to the end of the second angled portion 66 by a roughly 30 horizontal connecting portion 78. As figures 3 and 4 show, the lower end 42 of clamps 20, 20' is equipped with a longitudinal groove 80 formed in the lower face 20a of the clamp and running the length of the clamp. The alignment groove 80 is able to take the end 76a of 35 the alignment portion 76. The width 1' of the alignment groove 80 is such that, when the clamp is in the clamped position, the alignment portion 76 is not in contact with any of the vertical walls 80a, 80b of the alignment groove and so that, when the clamp is in the

mounting/demounting position depicted in figure 4, the end of the alignment portion 76 is pressed against the vertical wall 80a of the groove 80, which wall is closest to the heel of the tool.

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It will be understood that, when the clamp 20 is in its clamped position as depicted in figure 3, the running part 58b transmits to the fixing face 36a of the heel of the tool all of the clamping force produced by the 10 fixing surfaces 50 and 52 of the clamp.

When the clamp 20 is brought into its mounting/demounting position as depicted in figure 4 and no force is applied to the bending tool 34, the 15 stiffness of the blade 58 is enough for its running part 58b to be kept against the fixing face 36a of the heel of the tool and for the angled portions 64 and 66 to remain engaged in the groove 38 of the heel of the tool. In other words, the stiffness of the blade 58 is 20 enough to compensate for the weight of the tool. Effective retention of the tool is thus obtained when the clamp 20 is in this position.

When a downward force F is applied to the tool in order 25 to demount it, the upper chamfer 70 of the groove 38 of the tool acts on the start of the upper angled portion 64 and through elastic deformation causes the elastic blade to move aside and the angled portions to gradually leave the groove 38. This result is of course 30 obtained by virtue of the angling of the portion 64. When the chamfer 70 comes into contact with the vertex A of the two angled portions, the retention effect no longer exists and the tool can be removed.

35 It will be understood that, when there is a wish to fit the tool, the outer upper corner 82 of the heel 36 of the tool comes into contact with the lower part of the angled portion 66 of the blade 58. This upper corner, preferably chamfered, 82, causes the entire blade 58 to

move away progressively until the vertex A of the angled portions 64 and 66 comes into contact with the fixing face 36a of the heel of the tool. When the tool has been raised enough for the vertex A of the angled  
5 portions to come to face the upper part of the groove 38 as the tool is gradually raised, the angled portions 64 and 66 enter the groove 38 until the tool 34 arrives in its fixed position depicted in figure 4. In this  
10 position, the angled portions 64, 66 fully perform their retaining function. To fix the tool to the upper beam all that is then required is for the clamp 20 to be pivoted to return it to the position depicted in figure 2.

15 The function of the alignment portion 76 of the retaining end 58c of the elastically deformable blades 58 will now be explained. The end 76a of this portion enters the longitudinal groove 80 formed in the lower face of the clamp. As already explained briefly, this  
20 end 76a is not in contact with any of the vertical faces 80a and 80b of the groove when the clamp is in its clamped position depicted in figure 3. By contrast, when the clamp is brought into its mounting/demounting position depicted in figure 4, the end 76a of the  
25 alignment portion 76 comes into contact with the wall 80a of the groove 80. Thus, all the alignment ends 76 of the blades 58 are aligned on the position of the wall 80a. As a result, the vertices A of the angled portions 64, 66 of each blade are also aligned, making  
30 the tool easier to fit or to extract because all these vertices A are aligned.

This alignment of the vertices at the time of fitting of the tool avoids significant stressing of the  
35 deformable blades the vertices of which might not be suitably separated from the clamping face 14a.

Figure 5, which depicts a preferred embodiment of the retaining member 54, depicts in the zone Z the portions

of the elastically deformable blades 58 which deform elastically as the angled portions 64 and 66 of these blades are inserted into or extracted from the groove 38 of the heel of the bending tool 34.